SIMULTANEOUS DISTAL LIGATION OF THE RIGHT COMMON CAROTID AND RIGHT SUBCLAVIAN ARTERIES FOR SUPPOSED INNOMINATE ANEURISM[1]

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A FEMALE, partly Indian, partly Negro, æt. 38, presented herself at the Surgical clinic of the Woman's Medical College of Baltimore, in the latter part of the summer of 1889. For two years she has noticed a small pulsating lump at the root of the neck behind the right sterno-cleido-mastoid muscle. This lump increased slowly, accompanied with discomfort, oppression of breathing, more or less cough and hemicrania, and on account of these ailments, she applied for treatment. Upon inspection a pulsating tumor was seen, situated at the root of the neck, just above right-sterno clavicular articulation and raising the right sterno cleido-mastoid muscle with each impulse of the heart. The pulsating area appeared about the size of a small hen's egg. A distinct, but not very loud, bruit was heard over the tumor. There was no perceptible difference between the radial pulses, but the right carotid artery did not seem to beat so forcibly as the left. She was admitted to the Hospital of the Good Samaritan, where she was kept under observation, and the following additional facts learned in regard to her history. For a long time she has indulged to excess in the use of liquor, and has led a wild life. She has had five children, or premature births. She denied having contracted syphilis, but it is probable that she did, though there were no specially characteristic symptoms of the disease present The urine was increased in amount but did not contain albumen, nor did a microscopic examination reveal casts. The heart sounds were normal, except that the second sound seemed to be a little accentuated. The lungs appeared to be healthy. There was no tracheal tug, which is sometimes present when the aorta is the seat of aneurism. My colleagues upon the medical side, Profs Cordell and Thomas, concurred in the diagnosis of innomina'e aneurism, but Prof. Thomas thought that the first portion of the subclavian and the arch of the aorta were also involved, as there was some thoracic dullness upon percussion. She was placed flat in bed and kept on very low diet, causing her to complain that she was being starved, and 10 grains iodide potash was given 3 times a day. She did not improve much under this treatment, which was continued for about six weeks. The lump seemed to become larger, and the choking, cough, oppression and headache increased. No treatment seemed to relieve these symptoms, but, on the contrary, they became worse; severe epistaxis also occurred upon several occasions. As medical treatment had not yielded any good result, it was decided to ligate the right common carotid and the subclavian arteries. A few days previous to the operation, the patient went home on a visit and returned intoxicated almost to the verge of mania-a-potu. On November 29, 1889, the patient having been antiseptically prepared, the right common carotid was exposed by an incision along the inner border of the sterno-mastoid muscle. The neck was thick, and the artery placed deeply, which rendered this part of the operation rather tedious. The vessel was ligated with stout juniper oil catgut, below the omohyoid muscle, the internal jugular vein not being seen. Immediately upon tightening the ligature the heart's action became tumultuous and irregular and the tumor harder and larger. After waiting awhile for the heart to become quieter, the third portion of the subclavian was exposed by an incision along the clavicle, the fascia being torn through and the veins drawn aside. The artery was deeply placed, but was found without difficulty, and was tied externally to the scalenus anticus muscle, catgut being used. Upon tieing the ligature the aneurism became smaller and softer, and the radial pulse immediately ceased, whilst the heart's action became more nearly natural. No cerebral symptoms supervened at any time. The arm was wrapped with cotton-wool and the neck padded with the same, after having closed the wounds with catgut and applied an iodoform and bichloride dressing. Within 24 hours the recurrent circulation was completely established, and a very small but distinct radial pulse could be felt. The temporal pulsation never returned. The temperature reached 101.2° on the evening of the second day, falling to normal the next evening. The pulse was increased in frequency at once, varying from 115 to 130 beats per minute, and at the end of four weeks was still 100. The respiration was also accelerated for a long time. She was kept in bed on low diet for several weeks after the operation, and the aneurismal swelling seemed to diminish, but did not disappear. The wounds healed promptly without suppuration. For a while there was some numbness about the right arm, but this gradually disappeared.

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[1] Read at the semi-annual meeting of the Medical and Chirurgical Faculty of Maryland, held at Cambridge, Md., Nov. 12 and 13, 1890.

I had the opportunity of examining this woman about one year after the operation, and she seemed to be cured; the lump, pulsation and bruit had almost entirely disappeared.

I place this case upon record as a contribution to the history of the distal ligation of the carotid and subclavian vessels for the relief of innominate and aortic aneurisms. Mistakes in the diagnosis of aneurism of the innominate or aorta have been very frequent in the past, and literature teems with cases of supposed aneurism of one or the other of these vessels, in which errors of diagnosis have been made; hence I am not sure that this woman was suffering from this affection, though the diagnosis was confirmed by expert diagnosticians.

Aneurism is always a formidable disease, and when it affects the innominate artery or the arch of the aorta its gravity is vastly greater than when more superficial vessels are attacked. This arises from the fact that the vessels are not only of great size, but from the impossibility of applying either pressure or the ligature between the heart and the tumor. Various methods of treatment have been instituted for the cure or relief of these affections, which may be classified as the medical and operative methods. Amongst purely medical measures may be mentioned the postural and dietetic, as exemplified by Tuffnell's method. This consists in the restriction of the patient's food and drink to the lowest point compatible with fairly comfortable living, and the observance of recumbency for a period of several weeks or months; this is often associated with the administration of iodide of potassium, or of tincture of digitalis. There can be no doubt that excellent results have followed these methods, either singly or combined, and a careful trial of such should always be made before subjecting a patient to an operation, if the rupture of the aneurism does not appear to be impending. There is considerable divergence of opinion in regard to the utility of the iodide of potassium in the cure of aneurism, and this diversity is explained by Dr. G. W. Balfour (*London Lancet*, vol. i., 1886, p. 356), as being due to improper administration of the drug. He says the iodide should be administered every eight hours in increasing doses, guided by its action on the pulse. If the normal pulse rate is increased, the dose must be diminished. First learn the pulse rate in recumbency, then give ten grains every eight hours, increasing the dose by five grains every week, if the pulse remains normal. It causes hypertrophy of the aneurismal walls by lowering tension. Other methods of treatment are the galvano-puncture, and the introduction of wire, horsehair, or catgut into the sac through a canula. These measures have not been attended with such success as to justify their frequent repetition. For many years occasional attempts have been made to cure these aneurisms by the distal ligation of one or both of the great trunks which arise from the innominate artery, with variable success. We must, therefore, study the results of the operations for purposes of comparison under the following heads:

1. Ligature of right common carotid.
2. Ligature of right subclavian.
3. Ligature of left common carotid.
4. Consecutive distal ligature of right common carotid and right subclavian, third part.
5. Simultaneous distal ligation of right common carotid and right subclavian (third portion or axillary, first part).
6. Distal ligature of left carotid and left subclavian.

As elaborate papers have already appeared upon this subject by Dr. John A. Wyeth, of New York, in the *Amer. Jour. of the Med. Sci.*, January, 1881, and by Rosenstern, of San Francisco, in the *Archiv f. klin. Chirurg.*, 1886, p. 49, I will avail myself of their statistics to a large extent in the preparation of the following tables:

TABLE I.—LIGATURE OF RIGHT COMMON CAROTID, ALONE.

Operator.	*Number*	*Year*.........	*Vessel Involved.*	*Age*..........	*Sex*..........	*Result*........	*Cause of Death.*	*Kind of Ligature used*...	*Antiseptic*....	*Remarks.*
V. Mott.	1	1820	Innominate.	60	M.	D.	Secondary hæmorrhage.	?	No.	Died in 20 days.
Evans.	2	1828	Innominate and root of carotid.	30	"	R.		"	"	Permanent cure, lived for 30 years, abscess and rupture of sac.
Neumeister.	3	1829	Innominate.	51	"	D.	Cerebral complication. Died on 5th day.	"	"	
V. Mott.	4	1829	"	51	"	R.	Pressure on trachea.	"	"	Died in 7 months from pressure of the consolidated aneurism of the trachea.
Key.	5	1830	" and aorta.	61	F.	D.	Cerebral aneurism in a few hours.	"	"	Left carotid nearly obliterated.
Morrison.	6	1832	" and root of carotid.	42	M.	R.		"	"	Improved. Died suddenly 20 months later.
Scott.	7	1834	Innominate.			D.	Rupture of sac.	"	"	
Dohlhoff.	8	1837	"			"	Cerebral complications.	"	"	Died on 7th day.
O'Shaughnesay.	9	1840	? aorta.	42	M.	"	Died on 10th day; rupture of sac.	"	"	Died suddenly during some slight effort.
Hutton.	10	1841	Innominate.	47	"	"	Rupture of sac into trachea.	"	"	Died on 76th day. Secondary hæmorrhage and convulsions occurred.
Ferguson.	11	1841	" and root of right subclavian.	56	"	"	On 7th day.	"	"	Death the result of operation.
Porta.	12	1842	Innominate and roots of right carotid and subclavian.	60	F.	"	No cause given.	"	"	Died in 40 hours.
Rompani.	13	1844	Carotid and innominate.	70	M.	"	Secondary hæmorrhage.	"	"	Died on 21st day. Double aneur'sm of carotid and innominate.
Campbell.	14	1845	Innominate.	48	"	"	Suffocation from pressure.	"	"	Died in 19 days.

Vilardebo.	15	?	Double aneurism of right carotid, right subclavian and innominate.	70	M.	D.		?	No.	Died on 21st day.
Wright.	16	1855	Innominate.	70	“	“	Abscess of the brain.	“	“	Lived nearly 3 months.
Ordite.	17	1859	“			“		“	“	No particulars given.
Broadbent.	18	1860	“	50	“	R.		“	“	Died in 4 months.
Pirogoff.	19	1860	“	?	“	“		“	“	Improved, and lost sight of.
Nussbaum.	20	?	“			D.	Growth of aneurism.	“	“	
Nussbaum.	21	?	“			“		“	“	
Butcher.	22	1863	Dilatation of innominate aneurism of 1st part subclavian	42	“	“	Death in 88 hours.	“	“	Innominate and 1st part of subclavian enormously dilated.
Hutchison.	23	1867	Aorta, innominate and right carotid & right subclavian.	48	“	“	Death in 41 days from suffocation.	“	“	Also attempted to tie right subclavian, but the vessel was not included in the ligature
Hewson.	24	1867	Aorta and innominate.	51	“	“	Died on 10th day. Asphyxia from pressure.	“	“	
Annandale.	25	1875	Aorta.	62	“	R.			Yes	Patient very much improved.
Bryant.	26	1877	“	56	“	D.	Died on 10th day.	Catgut.	“	Operation had done no good.
Reyher.	27	1879	Innominate.	52	“	R.				Improved.
Küster.	28	1879	“			D.	Died in 40 hours; œdema of lungs.	“	“	
Bryant.	29		“			R.				“
Kuster.	30		“			“				“
Golding Bird.	31	1883	“	28	“	D.	Died in 6 days.			Retropharyngeal abscess.
Ferguson.	32	1884	“	43	“	R,		Chromic gut.		Œdema of lungs; died 2 years later.
Ashhurst.	33	?	Aortic.			“				No improvement.

TABLE II.—LIGATURE OF RIGHT SUBCLAVIAN ALONE.

Operator.	Number……	Year………	Vessel Involved.	Age………	Sex………	Result ……	Cause of Death.	Kind of Ligature used..	Antiseptic….	Remarks.
Wardrop.	1	1827	Innominate.	41	F.	R.			No.	Died 2 years and 2 months later.
Langier.	2	1834	"	57	M.	D.	Secondary hæmorrhage.			Died in 1 month, bleeding from peripheral end of subclavian.
Broca.	3	1862	"	50	"	R.				Died in 6 months from gangrene of the lung.
Lane.	4	?	"	?	"	D.				Died in 8 days.
Bryant.	5	1871	"	33	"	R.		Carbol. catgut		Died in 3 years from pressure of the aneurism.

TABLE III.—LIGATURE OF LEFT COMMON CAROTID ALONE.

Operator.	Number……	Year………	Vessel Involved.	Age………	Sex………	Result……	Cause of Death.	Kind of Ligature used…	Antiseptic….	Remarks.
Montgomery.	1	1829	Aorta.	40	M.	R.			No.	Improved, but died in 4 months from hæmorrhage.
Tillanus or Rigen.	2	1829	"		"	"			"	Improved, but died in 5 months from asthma and spasm.
Pirogoff.	3	?	"	?	"	"			"	Left hospital in 2½ months very much improved.
Pirogoff.	4	?	Innominate and aorta.	?	F.	D.	Death in 3 weeks.			Hemiplegia.

Heath.	5	1872	Aorta.	48	M.	R.		Catgut.	Yes	Great relief, died 4½ years after operation.
Heath.	6	1874	"			D.	Death in a few hours from cerebral aneurism.		"	Right carotid had been previously obliterated.
Holmes.	7	1875	End of arch of aorta.	21	F.	R.			"	Alive 7 months later.
Barwell.	8	1877	Transverse aorta.	56	M.	"			"	Improved, and died in 4 months of kidney disease.
Dauchez.	9	1879	Aorta mistaken for carotid.			"				Improved, but died in 13 months.
Hardie.	10	1880	Transverse aortic.			"		Carbol. silk.		Died 6 years later. Ligature unchanged.
Bryant.	11	1881	Innominate.			D.	Died on 19th day.	Catgut.		Operation increased the growth. Death from pulmonary œdema and gangrene.
Ashhurst.	12	?	Aorta.			R.				Improved for a while.
Heath.	13	1890	"	38	M	"	Died in 2 months.			Cocaine anæsthesia.

TABLE IV.—CONSECUTIVE DISTAL LIGATION OF THE RIGHT COMMON CAROTID, AND RIGHT SUBCLAVIAN THIRD PORTION.

Operator.	*Number......*	*Year.........*	*Vessel Involved.*	*Age.... ...*	*Sex..........*	*Result.. ....*	*Cause of Death.*	*Kind of Ligature used...*	*Antiseptic....*	*Remarks.*
Wickham.	1	1827	Innominate.	55	M.	D.	Rupture.	Silk.	No	Died of pleurisy—alcoholic.
Fearn.	2	1836 1838	"	28	F.	R.	Died 4 months after last operation.		"	Greatly improved.
Malgaigne.	3	1845	"	46	M.	D.	Rupture of sac 21 days, after operation.			Alcoholic.
Bickerstech.	4	1864	Aorta and innominate.	35	"	R				Died in 3 months from the progress of the disease.
Speir.	5	1874	Aorta supposed innominate.	31	"	D.	Rupture of sac on 34th day.			Speir's constrictor to carotid; 48 hours later tied subclavian.

TACLE IV.—CONTINUED.

Operator.	*Number....*	*Year ... .*	*Vessel Involved.*	*Age.........*	*Sex..........*	*Result........*	*Cause of Death.*	*Kind of Ligature used...*	*Antiseptic....*	*Remarks.*
Doughty and Mott.	6	1875 1876	Innominate.	40	M.	R.				Greatly improved. Died of phthisis 3 years after operation.
Küster.	7	1879	Aorta.	37	"	"		Carbol. catgut		Died 3 months after last operation, wounds healed.
Adams and Treves.	8	1880	Innominate.	47	"	D.	Died 37 days after last operation; rupture of sac.	Catgut.		Carotid not obliterated, subclavian obliterated.
Wolf.	9	1882	Aorta.	32	"	R.		Silk.		Died 5 months after last operation.
Schede.	10	?	"	?	"	D.	Secondary hæmorrhage.			
Gay.	11	?	Innominate.	38	"	R.		"		Great improvement. Died 1 year later, ligated carotid and 2 months later subclavian.

TABLE V.—SIMULTANEOUS DISTAL LIGATION OF RIGHT CAROTID AND RIGHT SUBCLAVIAN.

Operator.	*Number....*	*Year.........*	*Vessel Involved.*	*Age ....*	*Sex..........*	*Result........*	*Cause of Death.*	*Kind of Ligature used ..*	*Antiseptic....*	*Remarks.*
Hobart.	1	1839	Aorta mistaken for innominate	25	F.	D.	Died on 16th day; hæmorrhage from carotid.		No.	Common carotid tied 1 inch above origin. Subclavian in its 1st part.
Rossi.	2	1844	Innominate.			"	Died on 6th day. Left carotid and right vertebral obliterated.		"	As the left vertebral was the only vessel to carry on the cerebral circulation, he probably died of anæmia of the brain.

C. Heath.	3	1865	Aorta mistaken for innominate.	30	F.	R.			?	Great improvement. Died from external bursting of an aortic aneurism, 4 years and 17 days after the operation.
Maunder.	4	1867	Aorta mistaken for innominate.	37	M.	D.	Died on 5th day; occlusion of aorta by clot.		"	Clot projected from innominate into aorta.
Hodges.	5	1868	No true aneurism.	55	"	"	Died on 12th day; exhaustion.		"	Fusiform dilatation of innominate and aorta, but no true aneurism.
Sands.	6	1868	Aorta mistaken for innominate.	43	F.	R.	Died in 13 months.	Silk or thread	No.	Tumor diminished and visible pulsation ceased.
Jas. Lane.	7	1871	Innominate and aorta.	40	"	"	Died in about 50 days from bursting of sac.	Silk.	Yes	Improved and left hospital in 46 days. Death suddenly about 50th day.
Holmes.	8	1871	"	40	M.	"	Died on 55th day; œdema and exhaustion.	Catgut.	"	One month after operation galvano puncture, later sac opened with knife.
McCarthy.	9	1872	" and aorta.	45	"	D.	Died on 16th day from hæmorrhage.	Silk.		Bleeding from subclavian ulceration at seat of ligature.
Durham.	10	1872	"	?	"	"	Died on 6th day; apparently from shock.	"		Ligated subclavian, first the carotid.
Ensor.	11	1874	"	50	"	R.	Died on 65th day from rupture of aneurism.	"		Progressed favorably. Exposed himself and contracted rheumatism. Aneurism ruptured below carotid ligature.
Weir.	12	1876	"	45	"	D.	Died on 15th day from rupture of aneurism.	Catgut	"	Pulsation returned in right temporal in 2 hours and in radial in 6 hours.
Elliott.	13	1876	"	41	"	"	Died on 26th day: hæmorrhage from sac.	Silk.		Ulceration of tumor. Rupture of aneurism.
King.	14	1876	"	37	"	R.	Death on 111th day from rupture of aneurism.	Catgut.	"	Much improved. Got on a spree and died of hemorrhage.
Little.	15	1877	"	46	"	"	Death from pleurisy 3 years and 4 months after operation	"		Subclavian tied first. Permanently cured Death not connected with operation.
Barwell.	16	1877	Aorta and innominate.	45	"	"	Death from broncho-pneumonia in 100 days.	"	"	Ligature of carotid, and 24 hours later subclavian. Aneurism cured.
Barwell.	17	1877	" "	37	F.	"	Death in 19 months from bronchitis.	"	"	Great improvement in February, 1879. Married in Feb., 1879.

TABLE V.—CONTINUED.

Operator.	*Number.....*	*Year.........*	*Vessel Involved.*	*Age...*	*Sex...........*	*Result........*	*Cause of Death.*	*Kind of Ligature used...*	*Antiseptic....*	*Remarks.*
Barwell.	18	1877	Innominate.	48	M.	D.	Died 30 hours probably from the anæsthetic	Catgut.	Yes	Patient never recovered from the ether, remained cyanosed.
Barwell.	20	1879	"	48	"	"	Died on 7th day. Asphyxia.	Carbol. silk. Aorta.	"	Fusiform dilatation of arch of aorta, and aneurism of innominate.
Barwell.	21	1879	Aorta.	36	"	R.	Died in 15 months of a new aneurism.	Flat ox ligature	"	Great improvement, lived 15 months in comfort, original aneurism completed cured.
Ransohoff.	19	1878	Innominate.	27	F.	"		Catgut.	"	Great improvement Still alive when reported.
Stimson.	22	1880	"	34	M.	"		"	"	Cured Died of phthisis 21 months after operation. Aneurism cured.
Palmer.	23	1880	" and aorta.	50	F.	"	Died in 4 months of hæmorrhage.	Hemp.	No.	Aneurism filled with laminated clot, communication innominate and vein, opening into trachea.
Lediard.	24	1880	Aorta.	42	M.	"	Died 11 mo. after operation.	Lig. ox. aorta.	"	Great improvement, aneurism filled with hard clot at autopsy 11 months after operation.
Wyeth.	25	1880	"	42	F.	"	Died 1 year later Acute diarrhœa.	"	"	Great improvement; almost cured but a small cavity remained. Woman addicted to drink.
King.	26	1880	Root of neck.	40	M.	"	Living when reported	Antiseptic silk	"	Dismissed 8 weeks after operation; aneurism smaller and patient free from pain.
Marsh.	27	1881	Aorta.	30	"	D.	Ruptured on 51st day.	Chromic catgut	Yes	Rapid enlargement of aneurism to left after operation.
Pollock.	28	1881	Innominate.	37	"	"	Dyspnœa.	Catgut & tendon.	"	Catgut ligature for carotid, Kangaroo tendon for subclavian.

Langley—Brown.	29	1881	Innominate.	32	M.	R.		Chromic catgut	Yes	Improved. Living 2 years later.
Cameron.	30	1882	"	57	F.	"		Catgut.	"	Alive and well 20 months after operation.
Lane.	31	1882	"	?	M.	"	Died in 10 months.	Carbol. silk.		Marked relief, returned to work; died after 10 months.
v. Bergmann.	32	1883	"	40	"	"			"	Improved, rapid healing, decrease in size.
May.	33	1883	"	40	"	D.	Died in 2 days from cyanosis.	Catgut.	"	Tied axillary, 1st part and carotid.
Rosenstern.	34	1883	"	42	F.	R.		Silk.	"	Ligatures on carotid separated in 5 or 6 weeks. On subclavian in 3 months. Great improvement. Alive and at work 2½ years later.
Gerster.	35	1884	"	51	M.	"		Catgut.	"	Tied axillary, 1st part, then carotid.
Barwell	36	1884	"	48	F.	"		Ox aorta.	"	All pulsation disappeared and patient seemed cured 6 months later.
Banks.	37	1884	"	?	M.	D.	Died in 1 month. Hæmorrhage from subclavian.	Kangaroo tendon lig.		Aneurism nearly filled with laminated fibrin.
Alexander.	38	1882	" and aorta.	48	F.	R.	Died in 6 months. Dyspnœa.	Catgut.	"	Some relief.
Beany.	39	?				"				Mentioned by Barwell in Article Med. Chir. Trans. 85, vol. lxviii, p. 124.
Beany.	40	?				"				" " "
Hartley.	41	1885	Innominate.		M.	"				Improved; patient exhibited Nov. 16, 1888. Aneurism extending.
Jessup.	42	?				D.	Hæmorrhage on 49th day.	Silk.		Reported by Mr. Ward.
Jessup.	43	?				R.		Catgut.		Aneurism not cured.
Jessup.	44	?				"		Silk.		Secondary hemorrhage, stopped by galvano puncture.
Jameson.	45	?	Aorta simulating innominate.	59	M.	"			No.	Result, 3 months freedom from pain.
Lawrie.	46	1885	Aorta.	38	"	"		Carbol. silk.	Yes	Much improved 4 months subsequently.

TABLE V.—Continued.

Operator.	*Number..*	*Year ....*	*Vessel Involved.*	*Age.........*	*Sex..........*	*Result.......*	*Cause of Death.*	*Kind of Ligature used...*	*Antiseptic...*	*Remarks*
Præger.	47	1836	Innominate.	60	M.	R.	Death from bronchitis 1 year p.-operationem.			Hemiplegia 2 days after operation, same day slight pulse in radial.
McBurney.	48	1886	"	35	"	"		Catgut.	Yes	Alive and apparently cured 18 months subsequently.
Ashhurst.	49	1886	"	42	"	"		"		Discharged 2 months subsequently.
Mynter.	50	1887	"	54	F.	"		"		Much improved.
Heath.	51	?	"			"		?	?	Discharged improved on 51st day.
Percival.	52	?	"			"		Chromic gut.		Marked improvement; antimony post-operationem seemed to be of benefit.
Wells.	53	?	Aorta.	70	F.	"		Catgut.		Apparently complete cure.
Dunlap.	54	?	Innominate.			"				Almost a cure, much improved.
Dunlap.	55	1888	"			?				Doing well when reported.
Packard.	56	1888	"	26	M.	D.	Suffocation, 5th day.	Catgut.		Aneurism the result of injury.
Meriwether.	57	1888	Aorta.	35	F.	R.		"		On 27th day no pulsation; considers her self cured.
J C. Warren.	58	1889	Innominate.	50	M.	"	Death in 3 months from rupture of aneurism.	Braided silk.		Tied 1st portion axillary between 2 portions pectoralis major.
Winslow.	59	1889	Supposed innominate.	38	F.	"	Still living	Catgut.	Yes	Wounds healed p.-p.; pulsation not arrested
Pettus.	60									Have not been able to come across report of this case.
Ashhurst.	61	1889	Aorta.	49	M.	R.		Catgut.	Yes	Aneurismal symptoms much improved.

TABLE VI.—CONSECUTIVE LIGATURE OF LEFT CAROTID AND LEFT SUBCLAVIAN OR LEFT AXILLARY.

Operator.	*Number...*	*Year........*	*Vessel Involved.*	*Age.........*	*Sex.........*	*Result........*	*Cause of Death.*	*Rind of Ligature nsed...*	*Antiseptic....*	*Remarks.*
Schede.	1	?	Arch of aorta.	34	M.	R.			Yes	Great improvement, died suddenly in 6 months.
Busch.	2	1880	Two aneurisms of aorta.	45	M.	D.	Died on 4th day.		"	First part of axillary tied. Operation of no benefit.

TABLE VII.—SIMULTANEOUS LIGATION OF LEFT CAROTID AND SUBCLAVIAN.

Operator.	*Number.. ...*	*Year........*	*Vessel Involved.*	*Age.........*	*Sex.........*	*Result ....*	*Cause of Death.*	*Qind of Ligature nsed...*	*Antiseptic....*	*Remarks.*
Wyeth.	1	1889	Aorta involving roots of left carotid and left subclavian.	48	M.	D.	Died in 72 hours.	Catgut.	Yes	

TABLE I.—DISTAL LIGATURE OF THE RIGHT CAROTID, ALONE.

Number of cases, 33; recovered, 11; cured, 1; improved, 7; died, 22.

Cause of death: Secondary hæmorrhage, 2; cerebral complications, 4; rupture of sac, 3; pressure, 4; œdema of lungs, 1; retro-pharyngeal abscess, 1; doubtful, 5.

Pre-antiseptic cases, 24; recovered, 5; cured, 1 (this patient lived for 30 years after the operation); died, 19.

Antiseptic, 9: recovered, 6; cured, 0; died, 3.

Males, 22; females, 2; unknown, 9.

TABLE II.—LIGATION OF RIGHT SUBCLAVIAN, ALONE.

Number of cases, 5; recovered, 3; cured, 0; improved, 3; died, 2.

Cause of death: Secondary hæmorrhage, 1; not stated, 1. One patient lived three years, one, two years and two months, and one only six months.

Males, 4; females, 1.

TABLE III.—DISTAL LIGATION OF THE LEFT COMMON CAROTID, ALONE.

Number of cases, 13; recovered, 10; apparently cured, 2; improved, 7; died, 3.

Cause of death: One case from hemiplegia in three weeks, one from cerebral anæmia in a few hours, and one from pulmonary œdema and gangrene.

Pre-antiseptic cases, 4; recovered, 2; died, 2.

Antiseptic, 9; recovered, 7; apparently cured, 2; died, 2.

Males, 6; females, 2; unknown, 5.

TABLE IV.—CONSECUTIVE LIGATION OF RIGHT COMMON CAROTID AND RIGHT SUBCLAVIAN, THIRD PORTION.

Number of cases, 11; recovery from operation, 6; cured, 1; improved, 4; died within 40 days, 5.

Cause of death: Rupture of sac, 4; secondary hæmorrhage, 1. Spier's constrictor was used in one case to carotid, and 48 hours subsequently the right subclavian was ligated. The patient died 34 days later from rupture of the sac.

Males, 10; females, 1.

TABLE V.—RESULTS OF SIMULTANEOUS DISTAL LIGATION OF THE RIGHT COMMON CAROTID AND RIGHT SUBCLAVIAN, THIRD PORTION, OR AXILLARY, FIRST PORTION.

Total cases, 59; recovered from operation, 43; apparently cured, 16; improved, 20; died, 16.

Antiseptic, 53; recovered, 41; apparently cured, 16; died, 12.

Pre-antiseptic, 6; recovered, 2; died, 4.

Ligature material, silk or thread, 20; recovered, 10; died, 10.

Cause of death: Hæmorrhage, 4; cerebral anæmia, 1; occlusion of aorta, 1; exhaustion, 1; shock, 1; asphyxia, 1.

Catgut, 26; recovered, 20; apparently cured, 8; died, 6.

Causes of death: Hæmorrhage, 0; rupture of sac, 2; anæsthetic, 1; cyanosis, 1; suffocation, 1; dyspnœa, 1.

Ox aorta, 4 cases; 4 recoveries; apparently cured, 3.

Males, 34; females, 16; unknown, 10.

Amongst these cases are included one in which the first portion of the right subclavian was tied, death resulting on the sixteenth day of hæmorrhage, and three in which the vessel was tied below the clavicle (first portion of axillary, English, third portion of subclavian, German); with one death on the second day from cyanosis, and two recoveries.

TABLE VI.—LIGATIONS OF LEFT COMMON CAROTID AND LEFT SUBCLAVIAN OR AXILLARY.

Consecutive, carotid and subclavian.—Number of cases, 1; recovered, 1; improved, 1.

Carotid and axillary: Number of cases, 1; died on fourth day.

Simultaneous carotid and subclavian: Number of cases, 1; died in 72 hours.

Males, 3; females, 0.

The cases here tabulated are not supposed to be all that have been operated on, but they are all that have been accessible to me for purposes of study aud comparison, and they are sufficient in point of numbers for the elucidation of the main features involved. I have not attempted to tabulate separately the results of operations for the relief of aneurisms of the arch of the aorta, but have included aortic and innominate aneurisms together. This would, perhaps, not have been the best procedure, but as the mistakes in diagnosis have been very numerous, and usually only discovered upon post-mortem examination, it is probably not a matter of much moment. A noticeable feature in this inquiry is the very much greater proportion of aneurisms affecting the male sex than the female; of the 98 cases in which operations were performed, and the sex recorded, 76 were male, and 22 female. This is in accordance with the well known law that aneurism is most frequent in the male sex, which the elder Gross attributes not so much to the more laborious occupations of men, as to the fact that women are not so prone to arterial degenerations. A glance at the histories of these cases also shows a very large proportion of habitual topers; and the fatal result in not a few cases is directly traceable to the evil effects of a debauch. The ages of those subjected to operation varied from 21 to 70 years, which classified in decennial periods is as follows: From 21 to 30, 5 cases; 30 to 40, 22 cases; 40 to 50, 34 cases; 50 to 60, 19 cases; 60 to 70, 5 cases; over 70, 4 cases.

We will see by reference to the tables that the simultaneous distal ligation of the right common carotid, and the right subclavian arteries has been performed much more frequently than any other operation for the cure of these aneurisms, and with a much larger proportion of recoveries, $72^{3}/_{4}\%$, as compared with $54^{1}/_{2}\%$ in the consecutive distal ligation of the same vessels. Distal deligation of the right common carotid alone gives a percentage of recoveries of only $33^{1}/_{3}$, whilst the ligation of the right subclavian alone, which has only been performed five times, gives a proportion of 50% of recoveries. The left common carotid artery has been tied thirteen times for aortic aneurism, with a proportion of recoveries of nearly 77%, and with very great improvement in the patients, but this operation is only applicable to aneurisms affecting the summit and left extremity of the arch of the aorta. If we analyze the cases more carefully we shall find that the results have been materially modified by the introduction of antiseptic methods. As we cannot state definitely in every case whether the operation was conducted upon antiseptic principles or not, we will have to satisfy ourselves with referring to those cases which occurred before 1871 as pre-antiseptic, and those since as antiseptic operations, and we will find a most remarkable difference in the behavior of the two classes of cases. In the antiseptic simultaneous ligations of the right carotid and subclavian, the recoveries amount to $77^{1}/_{3}\%$, in the pre-antiseptic cases only $33^{1}/_{3}\%$ recovered. In the antiseptic distal ligation of the right common carotid artery, alone, the proportion of recoveries was $66^{2}/_{3}\%$; in the pre-antiseptic, $20^{3}/_{4}\%$. In the antiseptic distal ligation of the left common carotid, $77^{3}/_{4}\%$ recovered; in the pre-antiseptic, 50%. The best permanent results are also found to belong to the simultaneous distal ligation of the common carotid and subclavian of the right side, though Mr. T. Holmes thinks that about all the good which is obtained is to be had from ligation of the carotid first, and if necessity should occur, subsequently, the subclavian. Very interesting questions are raised in regard to the action of different kinds of ligatures when applied to these large vessels.

The early operations were performed without antiseptic precautions, and silk or hemp ligatures were used. This involved a more or less tedious convalescence, with suppuration, in those cases which recovered; and not unfrequently death from secondary hæmorrhage occurred upon the separation of the ligature. Of the operations performed within antiseptic times, for the ligation of the right common carotid and right subclavian, simultaneously, in 14 cases silk or thread was used, with 9 recoveries and 5 deaths, only one of the deaths, however, being from secondary hæmorrhage. In 26 cases catgut was used, with 20 recoveries and 6 deaths, none of the fatal cases resulting from secondary hæmorrhage. In 4 cases the flat ox aorta ligatures were used, all recovering; and in 2 cases kangaroo tendon was the ligature material, both terminating fatally. The number of observations recorded is too small for making any special generalization, but they are suggestive. There can be no doubt that a person is more exposed to the danger of secondary hæmorrhage when a nonabsorbable ligature is used, than when catgut or other absorbable material is made use of; but silk is more easily and effectively sterilized than an animal material. On the whole, however, an absorbable material secures more favorable results, and the question is more in regard to the particular animal tissue to be used, and the shape of the ligature. Barwell has especially eulogized the flat ligatures made from the aorta of the ox, and they have given satisfaction wherever used. His idea in introducing these ligatures was that the coats of the artery would not be cut through by the broad, tape-like ligatures, but that the circulation would be effectively shut off for a sufficient time to allow consolidation of the aneurism; and the ligatures would then be absorbed, leaving the artery simply closed by a diaphragm, where its walls had been in contact. Whilst good results have resulted from the use of this ligature, it is doubtful whether it possesses any advantage over ordinary stout, round catgut, and it seems to me to be pretty well proven that the best and safest way of occluding an artery is by constricting it with sufficient force to divide its inner coats and thereby cause complete severance of the continuity of the vessel. I think, therefore, that properly prepared catgut is the most available as well as the best ligature material to be used in these cases. Kangaroo and other tendinous ligatures are too difficult to obtain for general use, and do not seem to me to present any commensurate advantage. In one case Dr. Speir successfully occluded the right carotid artery with his "constrictor," and 48 hours later tied the subclavian. This was essentially a simultaneous operation, but is not included in the table of similtaneous ligations. If it were not for the fact that the use of a catgut ligature leaves but little to be desired, a further trial of Speir's "constrictor" might be made with advantage.

In looking over the causes of death, I find 7 cases in which the fatal result is definitely attributed to secondary hæmorrhage, and of these four in which the vessel was tied with silk or hemp, and 1 with kangaroo tendon. Bursting of the sac, either internally or externally, is by far the most frequent cause of death, occurring in from 10 days to 4 months after the operation. This is the natural tendency of all aneurisms, and it is remarkable that the sudden strain which is thrown upon the sac by the ligation of the great vessels coming from it, does not more frequently cause its rupture. Amongst the causes of death, we find "cerebral complications" occupying quite a prominent place. This is not to be wondered at, considering the sudden anæmia which is produced by the ligation of the common carotid, which, however, quickly passes off. In some cases several of the trunks leading to the brain have been previously obliterated, and the ligation of one of the remaining vessels produces such a degree of anæmia as to cause death. The ligation of the subclavian alone would naturally be supposed to favor cerebral embolism, but in the 5 cases in which the right subclavian has been ligated alone, no such result followed. Pressure symptoms belong to the natural history of aneurism, and we find that many succumb after operations to pressure on the trachea, bronchi, or lungs, producing cyanosis, dyspnœa and asphyxia, or œdema and gangrene of the lungs. In one case death is said to have been caused by the occlusion of the aorta, by a clot which projected from the innominate; this occurred on the fifth day *post-operationem.* One death is attributed to post-pharyngeal abscess, which was probably the result of infection at the time of the operation. In conclusion it may be stated that simultaneous distal ligation of the right common carotid and right subclavian artery, in its third portion, has not, *per se*, a very high rate of mortality, when performed antiseptically, with an absorbable ligature; and that in a large proportion of cases great benefit will follow, whilst in a small proportion of cases a permanent cure will be obtained.